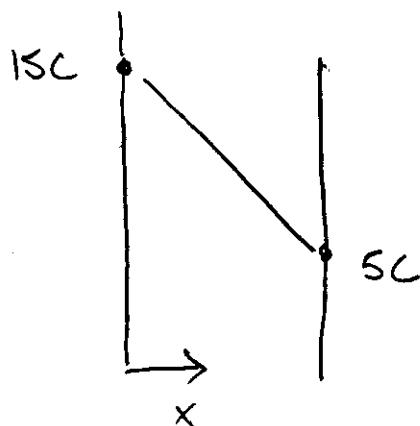


Problem 1.5

Glass Window

Given

$$A = 3 \text{ m}^2$$

$$K = 1.4 \text{ W/mk}$$

Fourier's Law

$$q = -KA \frac{\Delta T}{\Delta x}$$

$$q = -KA \frac{\Delta T}{\Delta x}$$

$$\Delta T = 10^\circ\text{C}$$

$$\Delta x = 0.005 \text{ m}$$

$$q = 8400 \text{ W}$$

$$q = 8.4 \text{ kW}$$

Problem 1.16 Cartridge Heater

In Water (Given)

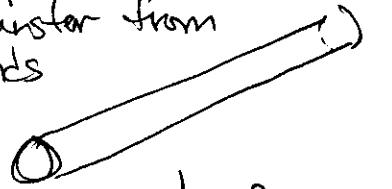
$$q = 2 \text{ kW}$$

$$\dot{Q} = 2000 \text{ W}$$

$$h = 5000 \text{ W/m}^2\text{K}$$

$$T_{\infty} = 20^\circ\text{C}$$

\* neglect heat transfer from ends



$$L = 200 \text{ mm}$$

$$D = 20 \text{ mm}$$

$$A_s = \pi D L$$

$$A_s = 0.01257 \text{ m}^2$$

Newton's Law of Cooling

$$q = h A_s [T_s - T_{\infty}]$$

$$T_s = \frac{q}{h A_s} + T_{\infty}$$

$$T_s = 51.8^\circ\text{C}$$

In Air

$$h = 50 \text{ W/m}^2\text{K}$$

$$\dot{Q} = 2000 \text{ W}$$

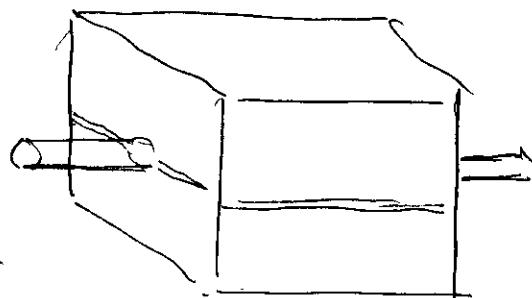
$$T_{\infty} = 20^\circ\text{C}$$

$$T_s = \frac{\dot{Q}}{h A_s} + T_{\infty}$$

$$T_s = 3202.3^\circ\text{C}$$

↑  
heater is going to melt before reaching this temperature.

Problem 1.23 Transmission Case



Power Input

$$P_i = 150 \text{ hp}$$

$$\eta_{tr} = 0.93$$

Cube : each side

$$W = 0.3 \text{ m}$$

$$A_s = 0.54 \text{ m}^2$$

Given

$$T_\infty = 30^\circ\text{C}$$

$$h = 200 \text{ W/m}^2\text{K}$$

$$q = P_i (1 - \eta) = 10.5 \text{ hp} \cdot \frac{\text{kW}}{1.341 \text{ hp}}$$

$$q = 7.83 \text{ kW}$$

Newton's Law of Cooling

$$q = h A_s [T_s - T_\infty]$$

$$T_s = \frac{q}{h A_s} + T_\infty$$

$$T_s = 72.5^\circ\text{C} + 30^\circ\text{C}$$

$$T_s = 102.5^\circ\text{C}$$